

Tracking

Multiple Objects Tracking

- Tracking is a very important section in self driving car.
- To do tracking based on point cloud data, basically it can be decomposed into three parts: object detection, data association and tracking.

Object detection

- The purpose of object detection is to separate different objects from a single point cloud.
- There are lots of approaches to do the object detection: Voxel-based deep learning, Point-based deep learning...
- In the final tracking competition, all the companies provide the detection results from their detection module.

Object detection results

- [ArgoAI](#)
 - [Waymo](#)
 - [Nuscenes](#)(No challenge this year)
-
- You can use the results directly, or you can do the object detection from raw data by yourselves.
 - We will offer a state-of-the-art detection approach in the next assignment for you to have a try later.

Data association

- After you get the object position, you can add different motion models or filters to estimate the next possible position (we call it prediction).
- With the prediction and new measurement, you can start working on the data association to link the objects in different time stamp.

Tracking

- After the data association, you can keep updating the states of objects in your tracking model.

Assignment

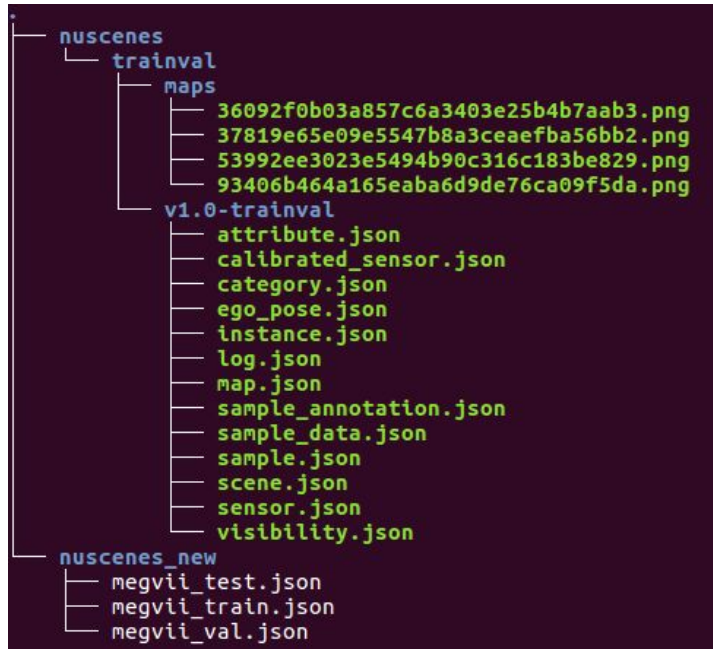
- In this assignment, we introduce a [tracking module](#) from Nuscenes tracking challenges last year.
- Please have a look at this [paper](#) and understand what's the pipeline in this tracking module.
- You need to run the code and answer some questions.

Probabilistic 3D Multi-Object Tracking for Autonomous Driving

- To run this module, please follow the steps from their [github](#). It's easy to setup the environments.
- Download the [detection results](#) from Nuscenes and put them in the directory /nuscenes_new
- Download the [raw data](#) from Nuscenes and put them in the directory /nuscenes
- Modify the path in *main.py*, *evaluate_nuscenes.py*, *get_nuscenes_stats.py* accordingly.
- Then you can track the detection results depends on the data you given in /nuscenes

Probabilistic 3D Multi-Object Tracking for Autonomous Driving

- For example, if you want to run the val dataset. You need to download Trainval/Metadata on the [webpage](#), the setting will be like this:



Probabilistic 3D Multi-Object Tracking for Autonomous Driving

- After you run the *main.py* and *evaluate_nuscenes.py*, please submit the *output.txt* in your result folder.

Question

1. Why we need to do data association in tracking module?
2. Which method does this module use for the data association? How it works?
3. How does this module compute the covariance matrix for Kalman filter? Any other method to compute the covariance? What's the difference?

Submit format

- Compress your file to hw5_<student_id.zip>(or any compressed file)
- In the compressed file, it should contain
 1. The output generate from the tracking module (**output.txt**).
 2. The answer from the questions above (**answer.pdf**).